

CLAIMS

What is claimed is:

1. A wireless, portable telephone comprising:

5 main housing;

a radio transmitter subsumed by said main housing;

a radio receiver subsumed by said main housing;

an alphanumeric keypad carried by said main housing;

an audio reproduction transducer subsumed by, and located near a

10 first end of said main housing, said transducer being adapted to produce
aural signals for near-ear placement;

a flip component swively attached to said main housing near a second
end;

at least one microphone element subsumed by said main housing;

15 a first acoustic transmission line embedded in said flip component and
coupled to a first opening in said flip component, and coupled through a first
outer input port in said main housing to said microphone element for trans-
porting acoustic energy received at said first acoustic transmission line to a
first position on said microphone element;

- a second acoustic transmission line embedded in said flip component and coupled to a second opening in said flip component, and coupled through a second outer input port in said main housing to said microphone element for transporting acoustic energy received at said second acoustic transmission line to said first position on said microphone element;
- 5 a third acoustic transmission line embedded in said flip component and coupled to a third opening in said flip component, and coupled through a first inner input port in said main housing to said microphone element for transporting acoustic energy received at said third acoustic transmission line to a second position on said microphone element;
- 10 a fourth acoustic transmission line embedded in said flip component and coupled to a fourth opening in said flip component, and coupled through a second inner input port in said main housing to said microphone element for transporting acoustic energy received at said fourth acoustic transmission line to said second position on said microphone element; and
- 15 a plurality of acoustic impedance elements, at least one being positioned in each of said acoustic transmission lines, and the at least one acoustic impedance element being substantially matched in specific acoustic re-

sistance to the specific acoustic characteristic resistance of the respective acoustic transmission line.

2. The telephone in Claim 1, wherein said acoustic transmission
5 lines have substantially matched acoustic impedances.

3. The telephone in Claim 1, wherein said acoustic transmission
lines have relative lengths to produce a cardioid polar response in said mi-
crophone element.

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4. The telephone in Claim 1, wherein said acoustic transmission
lines comprise flexible tubular hinges coupled between said flip component
and said microphone element.

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5. The telephone in Claim 1, wherein said ports need not lie in the
same plane.

6. A microphone assembly incorporated in a communication de-
vice, said microphone assembly comprising:

a microphone element adapted to convert acoustic energy into electrical energy;

an acoustic transmission line adapted to transmit acoustic energy received at the input port of said acoustic transmission line to an output port of

5 said acoustic transmission line coupled to said microphone element; and

at least one acoustic impedance element placed within said acoustic transmission line having a specific acoustic resistance that matches the specific acoustic characteristic resistance of said acoustic transmission line;

wherein the relative time and phase delays of acoustic energy propagating through said acoustic transmission line is proportional to the length of 10 said acoustic transmission line due to the elimination of standing waves.

7. The microphone assembly in Claim 6, wherein the specific acoustic characteristic resistance is defined by the product of the density of 15 the sound medium and the wave speed of sound in the medium, divided by the cross-sectional area of the acoustic transmission line.

8. A microphone assembly incorporated in a communication device, said microphone assembly comprising:

a microphone element adapted to convert acoustic energy into electrical energy;

a first acoustic transmission line adapted to transmit primary acoustic energy received at the input port of said first acoustic transmission line to an output port of said first acoustic transmission line coupled to a primary acoustic sound port of said microphone element; and

5 at least a second acoustic transmission line adapted to transmit secondary energy received at the input port of said second acoustic transmission line to an output port of said second acoustic transmission line coupled to a 10 secondary acoustic sound port of said microphone element;

wherein the specific acoustic characteristic resistance of said acoustic transmission lines are substantially matched by the specific acoustic resistance of at least one acoustic impedance element positioned in each said 15 acoustic transmission line, whereas standing waves are eliminated in the acoustic transmission lines allowing the relative time and phase delays of acoustic energy propagating through said acoustic transmission lines be proportional to the length of said acoustic transmission lines; and

wherein the acoustic energy received by said microphone element via said second acoustic transmission line is subtractive.

100 90 80 70 60 50 40 30 20 10 0

9. The microphone assembly in Claim 8, further comprising:

at least a third acoustic transmission line adapted to transmit primary acoustic energy received at the input port of said third acoustic transmission line to an output port of said third acoustic transmission line coupled to a primary acoustic sound port of said microphone element; and

5 at least a fourth acoustic transmission line adapted to transmit secondary acoustic energy received at the input port of said fourth acoustic transmission line to an output port of said fourth acoustic transmission line coupled to a secondary acoustic sound port of said microphone element;

10 wherein the acoustic energy received by said microphone element via said fourth acoustic transmission line is also subtractive.

10. A method of converting acoustic energy into electrical energy

15 comprising the steps of:

via an acoustic transmission line, transmitting acoustic energy received at the input port of said acoustic transmission line to an output port of said acoustic transmission line coupled to a microphone element;

via said microphone element, converting acoustic energy received from said acoustic transmission line into electrical energy; and

positioning at least one acoustic impedance element within said acoustic transmission line having a specific acoustic resistance that matches
5 the specific acoustic characteristic resistance of said acoustic transmission line;

wherein the relative time and phase delays of acoustic energy propagating through said acoustic transmission line is proportional to the length of said acoustic transmission line to eliminate standing waves.

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11. The method in Claim 10, wherein the characteristic impedance is defined by the product of the density of the sound medium and the wave speed of sound in the medium, divided by the cross-sectional area of the acoustic transmission line.

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12. In a communication device, a method of converting acoustic energy into electrical energy comprising the steps of:

via a first acoustic transmission line, transmitting primary acoustic energy received at the input port of said first acoustic transmission line to an

output port of said first acoustic transmission line coupled to a primary acoustic sound port of a microphone element;

via at least a second acoustic transmission line, transmitting secondary energy received at the input port of said second acoustic transmission line to
5 an output port of said second acoustic transmission line coupled to a secondary acoustic sound port of said microphone element;

via said microphone element, converting acoustic energy into electrical energy; and

positioning at least one acoustic impedance element in each said
10 acoustic transmission line, wherein the specific acoustic characteristic resistance of said acoustic transmission lines are substantially matched by the specific acoustic resistance of said acoustic impedance element, whereas standing waves are eliminated in the acoustic transmission lines allowing the relative time and phase delays of acoustic energy propagating through said
15 acoustic transmission lines be proportional to the length of said acoustic transmission lines;

wherein the acoustic energy received by said microphone element via said second acoustic transmission line is subtractive.

13. The method in Claim 12, further comprising the steps of:

providing at least a third acoustic transmission for transmitting primary acoustic energy received at the input port of said third acoustic transmission line to an output port of said third acoustic transmission line coupled

5 to a primary acoustic sound port of said microphone element; and

providing at least a fourth acoustic transmission line for transmitting secondary acoustic energy received at the input port of said fourth acoustic transmission line to an output port of said fourth acoustic transmission line coupled to a secondary acoustic sound port of said microphone element;

10 wherein the acoustic energy received by said microphone element via said fourth acoustic transmission line is also subtractive.

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